Introduction

This whitepaper discusses some of the features and issues specific to managing virtualized systems, such as HP Integrity Virtual Machines, using the HP system performance tools. This paper does not serve as an explanation of virtualization technologies, nor as an introduction to the tools themselves. The intended audience are those familiar with the HP performance tool software who are interested in how to apply them in environments where virtualization is being implemented.

People familiar with using the products HP Glance and the Performance Agent (PA, also called OVPA or MeasureWare) know they run on several platforms including HP-UX, Linux, Solaris, and AIX. PA also supports Windows. The data from PA is often exported into other tools or viewed by software such as the Performance Manager (PM, also called OVPM). HP as a company ranks first place in worldwide market share for the distributed performance and availability management software submarket. No matter which analysis tool you use, you will be able to take advantage of the enhanced functionality added to Glance and PA.

Previous product versions have run on various types of virtualized systems, however the latest releases now offer additional functionality in these environments. We have added new metrics and metric classes specific to virtualization for key virtual platforms starting in version 4.6 of Glance and PA. This allows you to analyze performance from various perspectives to get a complete picture of what is happening on your virtualized systems.

There are many ways to deploy virtual systems, and the terminology used to describe them varies from vendor to vendor. Generally, however, it is useful to think of a split between the “hardware side of things”, which are the physical systems that host the virtual environment, and the “software side of things” which are the partitions or guests supported from a host that run your applications. As an example, HP offers several different types of virtualization options for our hardware products that range from resource grouping to partitioning and full virtualization with Integrity Virtual Machines.

Glance and PA, like any application, can be run inside a partition or guest Operating System (OS) instance. With partitioning technologies, such as HP’s nPars, vPars, and PRM, the performance metrics that have been available for years in Glance and PA are accurate and useful for managing performance. Each cpu (processor) and other resources on the system map directly back to hardware resources. While limited dynamic reconfiguration of these systems is possible, the performance tools handle these changes well, adapting to changing numbers of enabled cpus. The performance of the larger (hardware) system hosting the partitions is effectively viewed as the combined performance of each partition. However, with fuller virtualization such as HPVM (Integrity Virtual Machines), the cpus inside a guest can be “virtual” processors that map indirectly to real physical processors. In some cases, many virtual cpus can all actually be sharing a physical processor pool. It gets worse: processing time on a guest can move slower or faster than real time (“wall clock” time), because the allocation of a virtual cpu to a physical cpu can vary depending on the configuration and the load. Unlike static partitioning technologies, dynamic virtual system behavior can differ significantly depending on the load of other guests hosted by the same physical server. The performance tools running on a guest show you a “logical” view of the system from the perspective of the guest OS.
**What’s New**

Because your applications and their processes are actually executing inside a virtualized system, you still want to be able to use tools like Glance and PA inside guests. That is the only way to see, for example, what specific processes on the guest are using the majority of your “logical” resources. However, there are additional things you would like to know about a guest from your performance tools, such as what that guest’s entitlements are and what physical resources are being consumed from the guest in addition to the logical view.

The amount of information that any software running on a guest OS instance or virtualization host can obtain varies significantly because the different virtualization technologies implement their particular performance instrumentation in unique ways. Also, each virtualization vendor offers management and configuration tools specific to their own technology. When we designed enhancements for PA and Glance to work better on virtualized systems, we set out to add value by enabling a set of metrics that can make sense independently from the platforms. Just like, for example, our existing performance metrics apply to platforms as varied as HP-UX, Windows, and Linux, our new virtualization metrics are also designed to provide the most important resource and entitlement data consistently from multiple platforms. The core value the HP system performance tools provide is to provide a way to manage performance across heterogeneous environments consistently and reliably.

Starting with Glance and PA version 4.6, we have added metrics to the tools so that when they run in virtual environments like HP Integrity Virtual Machine (HPVM), VMware ESX, and AIX LPARs, you have available information about entitlements and physical resources consumed by guests. The following chapters drill down into detail on each of these specific technologies.

To take advantage of the new PA 4.6 features, we have provided new templates for the PM and Reporter products that allow you to easily graph and report on virtualized systems. The ftp source for those templates is mentioned in the PA version 4.6 ReleaseNotes, and they will be included by default in future revisions of PM and Reporter. Even without the new templates, you can of course design your own from inside the tools to meet your specific needs.
HP Integrity Virtual Machines

Unlike some other virtualization technologies, HPVM provides a complete host Operating System environment to support and monitor all the guests. The host OS is always HP-UX, and regardless of your version of the performance tools, you will always see each guest represented by a unique process. The processes are named "hpvmapp". You can tell them apart by their command line, available in Glance, or via the ps or hpvmstatus commands. The cpu utilization and I/O load from each guest is represented accurately by the process cpu and I/O metrics always available in Glance and PA.

As of the 4.6 Glance release, shipped in June 2007 on the HP-UX AR0706 Application Release media, you will see a new screen when running on HPVM hosts: the Virtual Machine list, also called the Logical System list. In character-mode glance, it is accessed via the "V" hotkey. In xglance (gpm), it is on the Reports menu. This new screen shows all the guests with metrics representing their entitlement configuration and utilization. To see all the metrics available in character-mode glance, use the "S" key to select a guest of interest. To see all the metrics in xglance (gpm), click on Configure->Choose Metrics in the Logical Systems List and click on all the buttons. The default set shown in the initial screen are often not the most interesting metrics. There are about 20 metrics available. To see their meaning, in character mode glance use the "h" key, then hit Enter to see the current screen metrics, navigate with the arrow keys to the metric of interest and hit Enter again. In xglance, click on the "?" button in the upper righthand corner of the window and then click on the metric itself to bring up the online help. If you prefer to browse the metric help in a separate window, you will find all Glance metrics listed in the /opt/perf/paperdocs/ovpa/C/methpux.txt file.

Key metrics to watch on HPVM hosts include "Phys cpu%" (BYLS_CPU_PHYS_TO_TAL(Util)), which tracks the cpu utilization on the physical server system that was caused by the specific guest. This metric will correspond to the cpu util of the specific hpvmapp process associated with that guest, normalized over the number of cpus on the HPVM host. The “Logl cpu%” (BYLS_CPU_TO_TAL(Util)) metric is supposed to track the cpu utilization from the perspective of the guest. It would roughly match GBL_CPU_TO_TAL(Util) on the specific guest itself, although in the first release there was a known problem with that particular metric that you can check on the status of: QXCR1000417364. Also, there is “Entl Util%” (BYLS_CPU_EN_TL(Util)), which shows how much of this guest's minimum cpu entitlement is being consumed. Often, you will see the entitlement utilization go over 100%, because the cpu the guest is using exceeds its minimum guarantee on the server. When all guests are busy and contending for cpu, their entitlement utilization will be closer to 100%.

All these same metrics specific to virtualization are also available in PA logfiles as of its 4.6 version, which released at the same time as Glance 4.6 for HP-UX on the June 2007 AR. PA metrics can now include the new BYLS_class, enabled when you add "log logicalsystem" flag in the PA parm file. ReleaseNotes for Glance and PA discuss new features and metrics. They are available under the /opt/perf/ReleaseNotes directory after installation, and are also available separately from the product itself via the web from the HP documentation server².

VMware ESX

On VMware ESX technology, the Service Console Operating System supports all the guests and is actually running a derivative of Linux as a host OS. This host system is not a fully functional OS, and it does not support Glance. However, it is possible to install and run PA version 4.6 on the ESX console to report the “By Logical System” (BYLS_) metric set, detailing activity of the different guests. Note that PA running on the service console does not log process or application data at all. Its functionality is severely limited by the host environment.
Regardless of whether you choose to install PA on the ESX console, you can still install and run PA on VMware ESX guests that have the VMware tools package installed. In this mode (Glance included on Linux guests), you will see all the standard metrics, but also new metrics in 4.6 such as min and max cpu entitlements and physical utilization (GBL_CPU_EN TL_MIN, GBL_CPU_EN TL_MAX, GBL_CPU_PHYS_TOT UTIL). These are discussed in the version 4.6 / opt/perf/ReleaseNotes file. It is important to note that you can get the benefit of the 4.6 enhancements even if you do not decide to install PA on the ESX console, just by taking advantage of the new guest metrics. In addition, more detailed metrics unique to the VMware environment as well as OVO service map integration is available separately from the VMware Smart Plug-In.

AIX LPARs

The AIX Power5 virtualization system is called LPARs. Like HP-UX’s vPars or nPars virtualization mechanisms, there is not a full OS available as the host. Instead, a “hypervisor” controls all the partitions, which each behave as a separate system. As on other virtualized systems, previous versions of Glance and PA are supported on all revisions of AIX, and report valid statistics from the perspective of the partition they are running inside. In addition, as of version 4.6 of Glance and PA, you can enable collection of additional GBL_ and BYLS_ metrics for virtualization reporting. One partition can be configured to report on all the others, by use of the AIX Remote Statistics Interface technology. To collect and log cross-partition metrics, either xmservd or xmtopas from IBM must be running. The required libSpmi.a library and xmtopas are contained in the AIX perfagent.tools fileset and xmservd is in the Performance Toolbox for AIX component. In effect, you can configure one LPAR to monitor other LPARs as the HPVM host can monitor its guests. More information about setting this up is included in the PA product documentation and ReleaseNotes for 4.6.

Solaris Zones

The Solaris Zones (Containers) virtualization system is somewhat similar to HP-UX’s processor sets facility. Each defined zone can behave in a logically distinct fashion, nevertheless all processes running on all Zones are visible from performance tools running in the Global zone. Current versions of Glance and PA run in the Global zone only. In the future, there will be a feature added to the PA parm file that lets you bucket applications “by zone” to help you to distinguish processes running in different zones.

Analysis tools

The HP Performance Manager (known as OVM), as well as the Reporter, Performance Insight, and [OV-] Operations Manager all have integrations into the PA data. Thus, as you distribute PA to monitor virtualized environments, these analysis tools will offer connectivity into the performance metrics. As you roll out PA version 4.6 and enable the logicalsystems (BYLS_) metric class, you will be able to use new templates for PM and Reporter that show these metrics in those tools. Also, several capacity planning tools including HP Capacity Advisor, HyPerformix, OpN et, and SAS all access these same performance metrics originating in PA. Therefore you have a wide choice of analysis tools to view your environment. Going forward, you can expect to see further enhancements in these toolsets specific to virtualization, as HP continues to strengthen our performance management products.
For more information

- HP Event and Performance Management

References

1. HP ranked No. 1 in worldwide distributed system mgmt software market share
2. HP Virtualization Solutions http://www.hp.com/go/virtualization
4. Operations Manager Smart Plug-In for VMware
   http://h20229.www2.hp.com/partner/isv/nworks_prod1.jsp
5. Reporter and Performance Manager virtualization templates
7. HP partner companies for performance management: SAS, OPNET, HyPerformix
   http://managementsoftware.hp.com/partner/isv/index_company.jsp

© 2007 Hewlett-Packard Development Company, L.P. The information contained herein is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Itanium is a trademark or registered trademark of Intel Corporation or its subsidiaries in the United States and other countries.

author doug.grumann@hp.com, rev JUL07